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(30) Priority Data:
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(71) Applicant *(for all designated States except US)*: **ATRAVERDA LIMITED** [GB/GB]; 11B Stephenson Road, Speedwell Industrial Estate, Staveley, Derbyshire S43 3JN (GB).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **HILL, Andrew** [GB/GB]; Atraverda Limited, 11B Stephenson Road, Speedwell Industrial Estate, Staveley, Derbyshire S43 3JN (GB).

(74) Agent: **SHAW, Laurence**; Laurence Shaw & Associates, 5th floor, Metropolitan House, 1 Hagley Road, Edgbaston, Birmingham B16 8TG (GB).

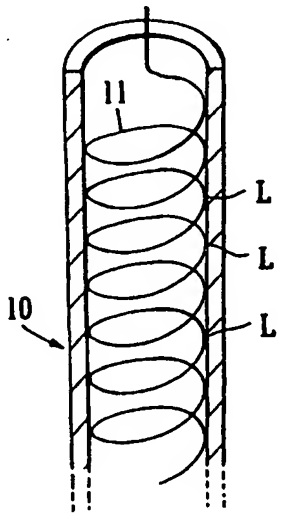
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRODE



(57) Abstract: An electrode comprises an elongate hollow tube (5) made of porous titanium suboxide the inside wall of which is contacted at spaced apart locations by an electrical conductor (11, 12) so that the current is substantially uniformly distributed along the length of the electrode.

WO 01/02626 A1

INTERNATIONAL SEARCH REPORT

Inter[illegible] Application No
PCT/GB 00/02553

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C25B9/04 C02F1/461

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C25B C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 422 917 A (HAYFIELD PETER C S) 27 December 1983 (1983-12-27) ESPECIALLY COLUMN 8, LINES 1-5	1-3,5-7, 9,10,14
X	GB 2 113 718 A (IMI MARSTON LTD) 10 August 1983 (1983-08-10) page 4, line 67-72; figures 6,7	1,2,5-7, 10,11
A	US 4 486 288 A (LINDER BJOERN H) 4 December 1984 (1984-12-04) column 3, line 59-61; figure 1	1-3
A	EP 0 224 851 A (HERAEUS ELEKTRODEN) 10 June 1987 (1987-06-10) the whole document	1,4

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 November 2000	21/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Devisme, F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Interi[redacted] Application No
PCT/GB 00/02553

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 410 410 A (DEBORSKI GARY A) 18 October 1983 (1983-10-18) the whole document	1
P,A	DE 198 44 329 A (SCHELLBACH WINFRIED ;UNIV SCHILLER JENA (DE)) 30 March 2000 (2000-03-30) the whole document	10,11
A	WO 97 11908 A (GAO TINGYAO ;HAN BAIPING (CN); ZHANG DESHENG (CN); LI JIE (CN); NA) 3 April 1997 (1997-04-03) the whole document	10,11

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Inter... Application No
PCT/GB 00/02553

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4422917 A	27-12-1983	AU 547495 B	24-10-1985
		AU 7434381 A	18-03-1982
		CA 1179478 A	18-12-1984
		DE 3169684 D	09-05-1985
		EP 0047595 A	17-03-1982
		JP 1772147 C	14-07-1993
		JP 2025994 B	06-06-1990
		JP 57079189 A	18-05-1982
GB 2113718 A	10-08-1983	AU 1004883 A	04-08-1983
US 4486288 A	04-12-1984	AU 1339383 A	24-10-1983
		DE 3337005 C	22-10-1992
		DE 3337005 T	20-09-1984
		DK 510083 A,B,	07-11-1983
		EP 0102380 A	14-03-1984
		GB 2125827 A,B	14-03-1984
		WO 8303264 A	29-09-1983
		SE 8306144 A	09-11-1983
EP 0224851 A	10-06-1987	DE 3541845 C	08-01-1987
		AT 47432 T	15-11-1989
		DE 3666465 D	23-11-1989
US 4410410 A	18-10-1983	NONE	
DE 19844329 A	30-03-2000	NONE	
WO 9711908 A	03-04-1997	AT 181901 T	15-07-1999
		AU 7619396 A	17-04-1997
		DE 19680818 D	17-06-1999
		DE 59602408 D	12-08-1999
		EP 0862538 A	09-09-1998

ATENT COOPERATION TREA Y

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION RELATING TO PRIORITY CLAIM

(PCT Rules 26bis.1 and 26bis.2 and Administrative Instructions, Sections 402 and 409)

To:

SHIGA, Masatake
OR Building
23-3, Takadanobaba 3-chome
Shinjuku-ku
Tokyo 169-8925
JAPON

Date of mailing (day/month/year)	
31 January 2000 (31.01.00)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
PC-8291	
International application No.	International filing date (day/month/year)
PCT/JP99/05614	12 October 1999 (12.10.99)
Applicant	
SHOWA DENKO K.K. et al	

The applicant is hereby **notified** of the following in respect of the priority claim(s) made in the international application.

1. ☐ **Correction of priority claim.** In accordance with the applicant's notice received on: , the following priority claim has been corrected to read as follows:

   ☐ even though the indication of the number of the earlier application is missing.
   ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

2. ☒ **Addition of priority claim.** In accordance with the applicant's notice received on: 27 December 1999 (27.12.99), the following priority claim has been added:

   US 23 February 1999 (23.02.99) 60/121,436

   ☐ even though the indication of the number of the earlier application is missing.
   ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

3. ☐ As a **result of the correction and/or addition** of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:

4. ☐ **Priority claim considered not to have been made.**

   ☐ The applicant failed to respond to the Invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
   ☐ The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
   ☐ The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.

   The applicant may, before the technical preparations for international publication have been completed and subject to the payment of a fee, request the International Bureau to publish, together with the international application, information concerning the priority claim. See Rule 26bis.2(c) and the PCT Applicant's Guide, Volume I, Annex B2(IB).

5. ☐ In case where **multiple priorities** have been claimed, the above item(s) relate to the following priority claim(s):

6. A copy of this notification has been sent to the receiving Office and

   ☒ to the International Searching Authority (where the international search report has not yet been issued).
   ☒ the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Shinji IGARASHI
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 15 May 2000 (15.05.00)	
International application No. PCT/JP99/05614	**Applicant's or agent's file reference** PC-8291
International filing date (day/month/year) 12 October 1999 (12.10.99)	**Priority date** (day/month/year) 09 October 1998 (09.10.98)
Applicant NISHIMURA, Kunio et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

10 April 2000 (10.04.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Christelle Croci
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREA

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

SHAW, Laurence
Laurence SHAW & ASSOCIATES
5th Floor, Metropolitan House
1 Hagley Road, Edgbaston
BIRMINGHAM B16 8TG
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 20.09.2001

Applicant's or agent's file reference
P02907PCT

IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02553	03/07/2000	01/07/1999

Applicant
ATRAVERDA LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Ferro Vasconcelos, M

Tel.+49 89 2399- 8111

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P02907PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02553	03/07/2000	01/07/1999
International Patent Classification (IPC) or national classification and IPC C25B9/04		
Applicant ATRAVERDA LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which hav been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☒ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29/01/2001	20.09.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Mizera, E Telephone No. +49 89 2399 8580

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02553

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1,3-7	as originally filed			
2	as received on	18/08/2001	with letter of	13/08/2001

Claims, No.:

1-12	as received on	18/08/2001	with letter of	13/08/2001

Drawings, sheets:

1/1	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-12
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-12
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations
   see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

AS TO BOX V:

1. The following document is cited:

   D1: US-A-4 422 917 (HAYFIELD PETER C S) 27 December 1983 (1983-12-27)

2. Document D1 discloses a tube of low electrical conductivity material, such as TiO_x, which exhibits a certain amount of porosity. To the internal surface thereof a titanium spring is brought into contact, in order to establish electrical contact to the material (see Example 1 and col.6, l.2-15 and 51-61).

3. This corresponds exactly to the embodiment claimed in claim 1. In particular it is mentioned that porosity is an intrinsic property of TiO_x both in D1 and in the application. Neither a certain amount af porosity is defined in claim 1, which might establish novelty over D1, nor has it be shown by the applicant, that such an amount, or porosity at all, is important in order to solve a specific problem, which might support the required inventive step.

4. Claim 1, and claims 2-7, depending thereon, as well as the use of the claimed electrode according to any of claims 8-12, therefore lack novelty and inventive step under Art.33(2) and (3) PCT.

AS TO BOX VI:

DE 198 44 329 A (SCHELLBACH WINFRIED ;UNIV SCHILLER JENA (DE)) 30 March 2000 (2000-03-30)

AS TO BOX VII:

1. In claim 5 the word 'about', used in connection with the definition of a range, should be deleted under Art.6 PCT.

It is one object of this invention to provide a method of making an electrical connection to such an electrode which will solve this problem, particularly in the context of the electrode body being made of a porous material.

In one aspect the invention provides an electrode comprising an elongate generally hollow body formed of porous relatively low electrical conductivity material, and connection means comprising an elongate electrically conductive member for being connected to a power source, the connection means extending along inside the body and contacting the inner wall surface of the body at a plurality of spaced apart locations along the length of the body for causing the electrical current from the power source to be distributed substantially uniformly along the electrode.

The electrically conductive member has an electrical conductivity substantially higher (at least 2 orders of magnitude) than that of the electrode body. In one form the connection means is a coiled length of spring wire shaped so as to mechanically urge the coils into contact with the inner wall surface of the hollow body at regular intervals. In another embodiment separate conductor lengths are present at longitudinal spaced apart locations and each contacts the inner wall of the body.

The hollow body may be formed from a range of materials. Most preferably the electrode body is formed of a substoichiometric oxide of titanium of the form TiO_x where x is from about 1.99 to about 1.7. Such a body is generally porous since the more most cost-effective manufacturing routes to a cylindrical or hollow body of such materials results in a porous structure. Catalytic elements may be present. In a preferred embodiment the electrode body is formed of the substoichiom tric oxid of titanium and the electrode conductor is a valve metal, whereby a durable electrical connection is made.

CLAIMS

1. An electrode comprising an elongate generally hollow body (5) formed of porous relatively low electrical conductivity material, and connection means (11, 12) comprising an elongate electrically conductive member for being connected to a power source (4), the connection means extending along inside the body (5) and contacting the inner wall surface of the body at a plurality of spaced apart locations along the length of the body for causing the electrical current from the power source to be distributed substantially uniformly along the electrode.

2. An electrode according to Claim 1, wherein the connection means (11) is an elongate spring made from spring wire shaped so as to mechanically urge the coils into contact with the inner wall surface of the body (5) at longitudinally spaced apart locations.

3. An electrode according to Claim 1, wherein the conductor means (12) comprise separate conductors in contact with the inner wall surface of the body (5) at respective longitudinal spaced apart locations.

4. An electrode according to any preceding Claim, wherein the electrically conductive member has a conductivity at least two orders of magnitude higher than that of the body.

5. An electrode according to any preceding Claim, wherein the electrode body is formed of a substoichiometric suboxide of titanium of the form TiO_x where x is from 1.99 to about 1.7.

6. An electrode according to any preceding Claim, wherein the body is at least 200 mm long.

7. An electrode according to any preceding Claim, wherein the electrical conductor means is made of a valve metal.

8. Apparatus for use in electrolytic treatment of a liquid, the apparatus comprising a chamber containing the liquid to be treated, an anode and a cathode at least one of which is an electrode according to any one of Claims 1 to 7.

9. Apparatus according to Claim 8, wherein the liquid is aqueous effluent or water and the treatment is to remove pollutants.

10. A method of operating apparatus according to Claim 8 or 9 including supplying a current from the power source to the electrode at a density of above 10 $A.m^2$ of external anode area, whereby the voltage variation between any two points on the electrode is less than 200 mV.

11. An in-situ soil remediation system incorporating an electrode according to any of Claims 1 to 7.

12. Apparatus for performing a redox type reaction, incorporating an electrode according to any of Claims 1 to 7.

It is one object of this invention to provide a method of making an electrical connection to such an electrode which will solve this problem, particularly in the context of the electrode body being made of a porous material.

In one aspect the invention provides an electrode comprising an elongate generally hollow body formed of low electrical conductivity material, an electrical conductor being connected to a power source and located inside the body at spaced apart locations and arranged so that the current is distributed substantially uniformly along the electrode.

The conductor is made of a material with an electrical conductivity substantially higher (at least 2 orders of magnitude) than that of the electrode body. In one form the conductor is a coiled length of spring wire shaped so as to mechanically urge the coils into contact with the inner wall surface of the hollow body at regular intervals. In another embodiment separate conductor lengths are present at longitudinal spaced apart locations and each contacts the inner wall of the body.

The hollow body may be formed from a range of materials. Most preferably the electrode body is formed of a substoichiometric oxide of titanium of the form TiO_x where x is from about 1.99 to about 1.7. Such a body is generally porous since the more most cost-effective manufacturing routes to a cylindrical or hollow body of such materials results in a porous structure. Catalytic elements may be present. In a preferred embodiment the electrode body is formed of the substoichiometric oxide of titanium and the electrode conductor is a valve metal, whereby a durable electrical connection is made.

CLAIMS

1. An electrode comprising an elongate generally hollow body (5) formed of low electrical conductivity material, an electrical conductor (11,12) being connected to a power source (4) and located inside the body (5) at spaced apart locations and arranged so that the current is distributed substantially uniformly along the electrode.

2. An electrode according to Claim 1, wherein the electrical conductor (11,12) extends along substantially along the length of the body (5).

3. An electrode according to Claim 2, wherein the conductor (11) is a coil length of spring wire shaped so as to mechanically urge the coils into contact with the inner wall surface of the body (5) at longitudinally spaced apart locations.

4. An electrode according to Claim 1 or 2, wherein separate conductors (12) are present at longitudinal spaced apart locations and each contacts the inner wall of the body (5).

5. An electrode according to any preceding Claim, wherein the conductor has a conductivity at least two orders of magnitude higher than that of the body.

6. An electrode according to any preceding Claim, wherein the body is formed of a porous material.

7. An electrode according to Claim 6, wherein the electrode body is formed of a substoichiometric suboxide of titanium of the form TiO_x where x is from about 1.99 to about 1.7.

8. An electrode according to any preceding Claim, wherein the body is at least 200 mm long.

9. An electrode according to any preceding Claim, wherein the electrical conductor is made of a valve metal.

10. Apparatus for use in electrolytic treatment of a liquid, the apparatus comprising a chamber containing the liquid to be treated, an anode and a cathode at least one of which is an electrode according to any of Claims 1 to 9.

11. Apparatus according to Claim 10, wherein the liquid is aqueous effluent or water and the treatment is to remove pollutants.

12. A method of operating apparatus according to Claim 10 or 11 including supplying a current from the power source to the electrode at a density of above 10 $A.m^2$ of external anode area, whereby the voltage variation between any two points on the electrode is less than 200 mV.

13. An in-situ soil remediation system incorporating an electrode according to any of Claims 1 to 9.

14. Apparatus for performing a redox type reaction, incorporating an electrode according to any of Claims 1 to 9.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION RELATING TO PRIORITY CLAIM

(PCT Rules 26bis.1 and 26bis.2 and Administrative Instructions, Sections 402 and 409)

To:

SHAW, Laurence
Laurence Shaw & Associates
5th floor
Metropolitan House
1 Hagley Road, Edgbaston
Birmingham B16 8TG
ROYAUME-UNI

Date of mailing (day/month/year) 04 September 2000 (04.09.00)	
Applicant's or agent's file reference P02907PCT	**IMPORTANT NOTIFICATION**
International application No. PCT/GB00/02553	International filing date (day/month/year) 03 July 2000 (03.07.00)
Applicant ATRAVERDA LIMITED et al	

The applicant is hereby **notified** of the following in respect of the priority claim(s) made in the international application.

1. [X] **Correction of priority claim.** In accordance with the applicant's notice received on: 18 August 2000 (18.08.00), the following priority claim has been corrected to read as follows:

GB 01 July 1999 (01.07.99) 9915420.5

- [ ] even though the indication of the number of the earlier application is missing.
- [ ] even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

2. [ ] **Addition of priority claim.** In accordance with the applicant's notice received on: , the following priority claim has been added:

- [ ] even though the indication of the number of the earlier application is missing.
- [ ] even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

3. [ ] As a **result of the correction and/or addition** of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:

4. [ ] **Priority claim considered not to have been made.**
   - [ ] The applicant failed to respond to the Invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
   - [ ] The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
   - [ ] The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.

   The applicant may, before the technical preparations for international publication have been completed and subject to the payment of a fee, request the International Bureau to publish, together with the international application, information concerning the priority claim. See Rule 26bis.2(c) and the PCT Applicant's Guide, Volume I, Annex B2(IB).

5. [ ] In case where **multiple priorities** have been claimed, the above item(s) relate to the following priority claim(s):

6. A copy of this notification has been sent to the receiving Office and
   - [X] to the International Searching Authority (where the international search report has not yet been issued).
   - [X] the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Dominique DELMAS
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 27 March 2001 (27.03.01)	
International application No. PCT/GB00/02553	**Applicant's or agent's file reference** P02907PCT
International filing date (day/month/year) 03 July 2000 (03.07.00)	**Priority date** (day/month/year) 01 July 1999 (01.07.99)
Applicant HILL, Andrew	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

29 January 2001 (29.01.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Zakaria EL KHODARY
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

GB0002553

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P02907PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/02553	03/07/2000	01/07/1999
International Patent Classification (IPC) or national classification and IPC C25B9/04		
Applicant ATRAVERDA LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which hav been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☒ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29/01/2001	20.09.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Mizera, E Telephone No. +49 89 2399 8580

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02553

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1,3-7	as originally filed			
2	as received on	18/08/2001	with letter of	13/08/2001

Claims, No.:

1-12	as received on	18/08/2001	with letter of	13/08/2001

Drawings, sheets:

1/1	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-12
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-12
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations
   see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate she t

AS TO BOX V:

1. The following document is cited:

   D1: US-A-4 422 917 (HAYFIELD PETER C S) 27 December 1983 (1983-12-27)

2. Document D1 discloses a tube of low electrical conductivity material, such as TiO_x, which exhibits a certain amount of porosity. To the internal surface thereof a titanium spring is brought into contact, in order to establish electrical contact to the material (see Example 1 and col.6, l.2-15 and 51-61).

3. This corresponds exactly to the embodiment claimed in claim 1. In particular it is mentioned that porosity is an intrinsic property of TiO_x both in D1 and in the application. Neither a certain amount af porosity is defined in claim 1, which might establish novelty over D1, nor has it be shown by the applicant, that such an amount, or porosity at all, is important in order to solve a specific problem, which might support the required inventive step.

4. Claim 1, and claims 2-7, depending thereon, as well as the use of the claimed electrode according to any of claims 8-12, therefore lack novelty and inventive step under Art.33(2) and (3) PCT.

AS TO BOX VI:

DE 198 44 329 A (SCHELLBACH WINFRIED ;UNIV SCHILLER JENA (DE)) 30 March 2000 (2000-03-30)

AS TO BOX VII:

1. In claim 5 the word 'about', used in connection with the definition of a range, should be deleted under Art.6 PCT.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
P02907PCT		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/ 02553	03/07/2000	01/07/1999
Applicant		
ATRAVERDA LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [ ] as suggested by the applicant.

   [X] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.